STATISTICAL EVALUATION USING LOG-NORMAL DISTRIBUTION

PROJECT: Delphi Corporation - Vandalia Faciltiy - Vandalia, OH
LOCATION: MW-448D
COMPOUND: Trichloroethene
COMMENT:

Sample	
Order	Log Conc.
1	-0.96
2	-0.96
3	-0.96
4	-0.29
5	-0.04
6	-0.02
7	0.04
8	0.18
9	0.28
10	0.32
11	0.49
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Normal Distribution	
Probability	Quatrile
8.3	-1.38
16.7	-0.97
25.0	-0.67
33.3	-0.43
41.7	-0.21
50.0	0.00
58.3	0.21
66.7	0.43
75.0	0.67
83.3	0.97
91.7	1.38

Shapiro-Wilk Normality Test		
Residual	Coefficient (a)	Product (b)
1.45	0.5601	0.81
1.28	0.3315	0.42
1.24	0.2260	0.28
0.47	0.1429	0.07
0.08	0.0695	0.01
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.00	

Shapiro-Wilk Sum:	1.589
Shapiro-Wilk W:	0.852
Critical Value:	5.0%
Shapiro-Wilk Comparison W:	0.8500

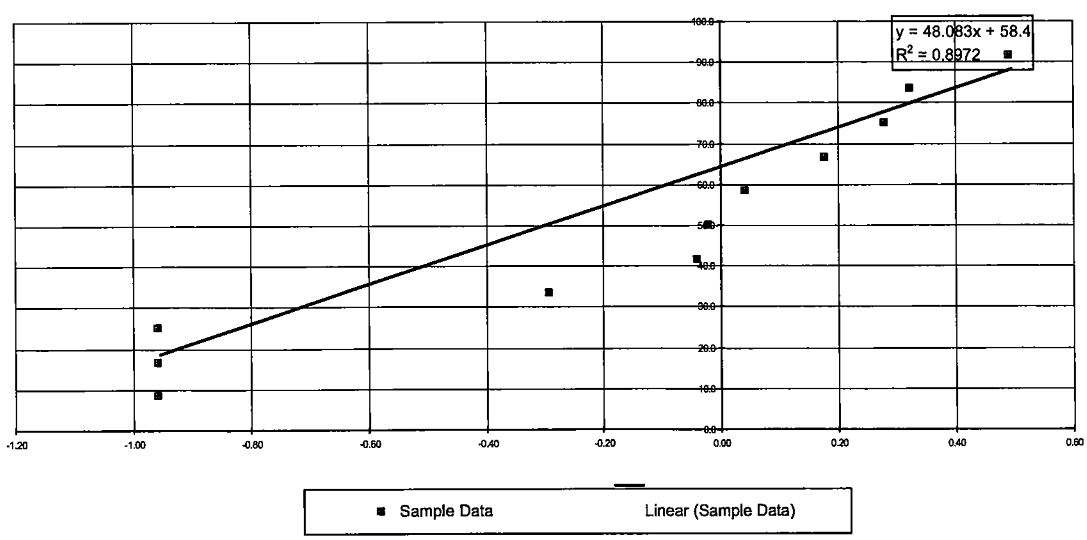
Normality?: Appears LogNormally Distributed

	log()
Number of Samples:	11
Sample Mean:	-0.175
Sample Standard Devation:	0.544

25% Quatrile:	0.3
50% Quatrile(median):	1.0
75% Quatrile:	1.7
Inter-Quatrile Range:	1.39
Upper Cutoff:	3.79

	log()	Natural Scale
Required Level of Confidence:	95%	
Upper Confidence Limit:	0.12	
Upper Tolerance Limit:	0.86	7.2

PROBABILITY PLOT



STATISTICAL EVALUATION USING NORMAL DISTRIBUTION

PROJECT: Delphi Corporation - Vandalia Faciltiy - Vandalia, OH
LOCATION: MW-449D
COMPOUND: Trichloroethene
COMMENT:

Sample	
Order	Concentration
1	9.3
2	38
3	42
4	43
5	45
6	47
7	50
8	51
9	54
10	61
11	62
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Normal Distribution	
Probability	Quatrile
8.3	-1.38
16.7	-0.97
25.0	-0.67
33.3	-0.43
41.7	-0.21
50.0	0.00
58.3	0.21
66.7	0.43
75.0	0.67
83.3	0.97
91.7	1.38

Shapiro-Wilk Normality Test		
Residual	Coefficient (a)	Product (b)
52.70	0.5601	29.52
23.00	0.3315	7.62
12.00	0.2260	2.71
8.00	0.1429	1.14
5.00	0.0695	0.35
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	

Shapiro-Wilk Sum:	41.344
Shapiro-Wilk W:	0.845
Critical Value:	5%
Shapiro-Wilk Comparison W:	0.8500

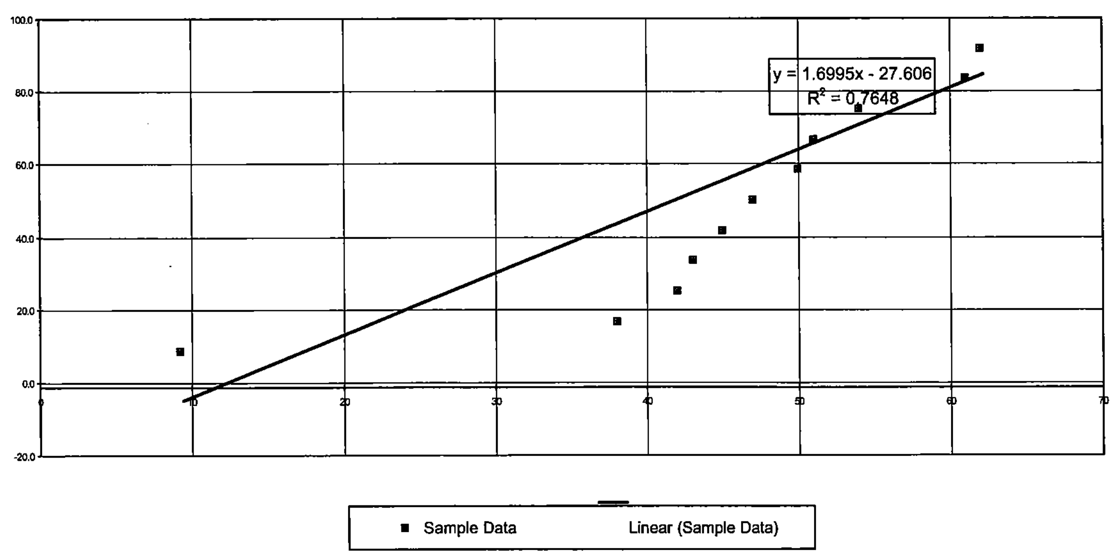
Normality?: Does Not Appear Normally Distributed

Number of Samples:	11
Sample Mean:	45.664
Sample Standard Devation:	14.222

25% Quatrile:	42.5
50% Quatrile(median):	47.0
75% Quatrile:	52.5
Inter-Quatrile Range:	10.0
Upper Cutoff:	67.5

Required Level of Confidence:	95%
Upper Confidence Limit:	53.44
Upper Tolerance Limit:	72.6

PROBABILITY PLOT



STATISTICAL EVALUATION USING LOG-NORMAL DISTRIBUTION

PROJECT: Delphi Corporation - Vandalia Faciltiy - Vandalia, OH
LOCATION: MW-449D
COMPOUND: Trichloroethene
COMMENT:

Sample	
Order	Log Conc.
1	0.97
2	1.58
3	1.62
4	1.63
5	1.65
6	1.67
7	1.70
8	1.71
9	1.73
10	1.79
11	1.79
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Normal Distribution	
Probability	Quatrile
8.3	-1.38
16.7	-0.97
25.0	-0.67
33.3	-0.43
41.7	-0.21
50.0	0.00
58.3	0.21
66.7	0.43
75.0	0.67
83.3	0.97
91.7	1.38

Shapiro-Wilk Normality Test		
Residual	Coefficient (a)	Product (b)
0.82	0.5601	0.46
0.21	0.3315	0.07
0.11	0.2260	0.02
0.07	0.1429	0.01
0.05	0.0695	0.00
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.00	

Shapiro-Wilk Sum:	0.568
Shapiro-Wilk W:	0.628
Critical Value:	5.0%
Shapiro-Wilk Comparison W:	0.8500

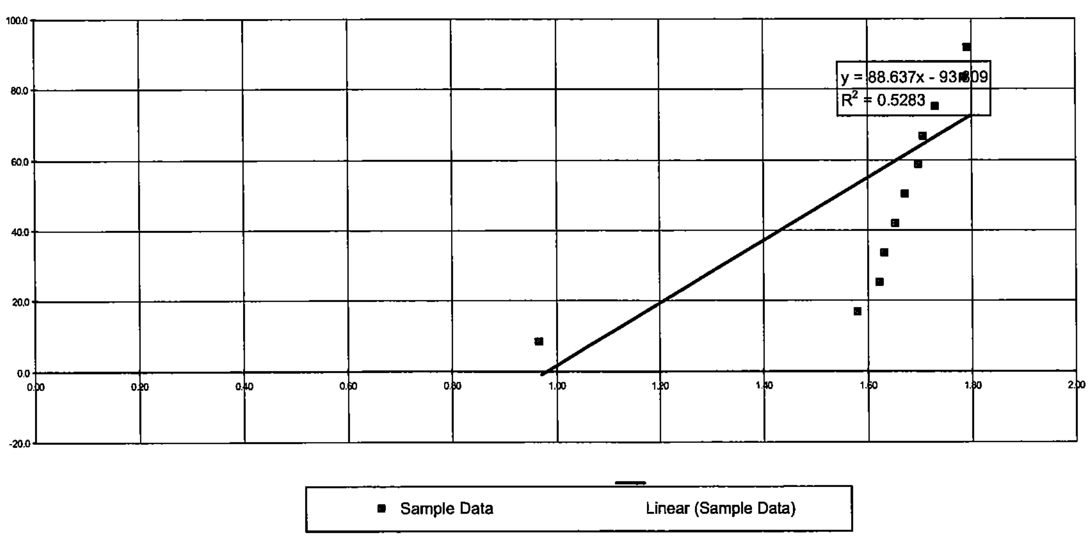
Normality?: Does Not Appear LogNormally Distributed

	log()
Number of Samples:	11
Sample Mean:	1.622
Sample Standard Devation:	0.227

25% Quatrile:	42.5
50% Quatrile(median):	47.0
75% Quatrile:	52.5
Inter-Quatrile Range:	10.00
Upper Cutoff:	67.50

	log()	Natural Scale
Required Level of Confidence:	95%	
Upper Confidence Limit:	1.75	
Upper Tolerance Limit:	2.05	112.6

PROBABILITY PLOT



STATISTICAL EVALUATION USING NORMAL DISTRIBUTION

PROJECT: Delphi Corporation - Vandalia Faciltiy - Vandalia, OH
LOCATION: MW-451D
COMPOUND: Trichloroethene
COMMENT:

Sample Order	Sample Concentration
1	12
2	23
3	27
4	28
5	28
6	41
7	48
8	55
9	61
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Normal Distribution Probability	Normal Distribution Quatrile
10.0	-1.28
20.0	-0.84
30.0	-0.52
40.0	-0.25
50.0	0.00
60.0	0.25
70.0	0.52
80.0	0.84
90.0	1.28

Shapiro-Wilk Normality Test Residual	Coefficient (a)	Product (b)
49.00	0.5888	28.85
32.00	0.3244	10.38
21.00	0.1976	4.15
13.00	0.0947	1.23
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	

Shapiro-Wilk Sum:	44.613
Shapiro-Wilk W:	0.944
Critical Value:	5%
Shapiro-Wilk Comparison W:	0.8290

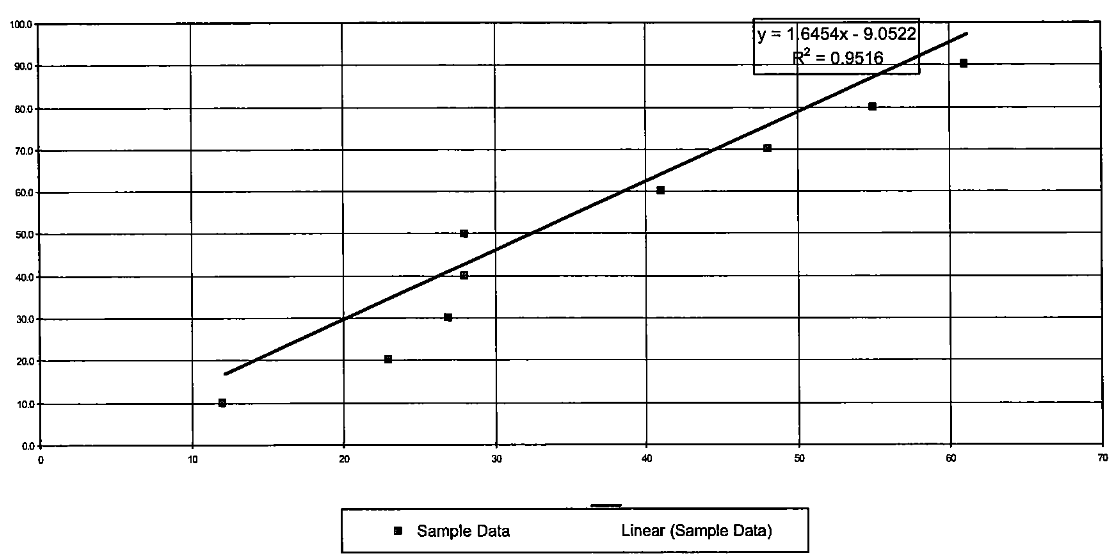
Normality?: Appears Normally Distributed

Number of Samples:	9
Sample Mean:	35.889
Sample Standard Devation:	16.236

25% Quatrile:	27.0
50% Quatrile(median):	28.0
75% Quatrile:	48.0
Inter-Quatrile Range:	21.0
Upper Cutoff:	79.5

Required Level of Confidence:	95%
Upper Confidence Limit:	45.95
Upper Tolerance Limit:	67.7

PROBABILITY PLOT



STATISTICAL EVALUATION USING LOG-NORMAL DISTRIBUTION

PROJECT: Delphi Corporation - Vandalia Faciltiy - Vandalia, OH
LOCATION: MW-451D
COMPOUND: Trichloroethene
COMMENT:

Sample	
Order	Log Conc.
1	1.08
2	1.36
3	1.43
4	1.45
5	1.45
6	1.61
7	1.68
8	1.74
9	1.79
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Normal Distribution	
Probability	Quatrile
10.0	-1.28
20.0	-0.84
30.0	-0.52
40.0	-0.25
50.0	0.00
60.0	0.25
70.0	0.52
80.0	0.84
90.0	1.28

Shapiro-Wilk Normality Test		
Residual	Coefficient (a)	Product (b)
0.71	0.5888	0.42
0.38	0.3244	0.12
0.25	0.1976	0.05
0.17	0.0947	0.02
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.00	

Shapiro-Wilk Sum:	0.604
Shapiro-Wilk W:	0.933
Critical Value:	5.0%
Shapiro-Wilk Comparison W:	0.8290

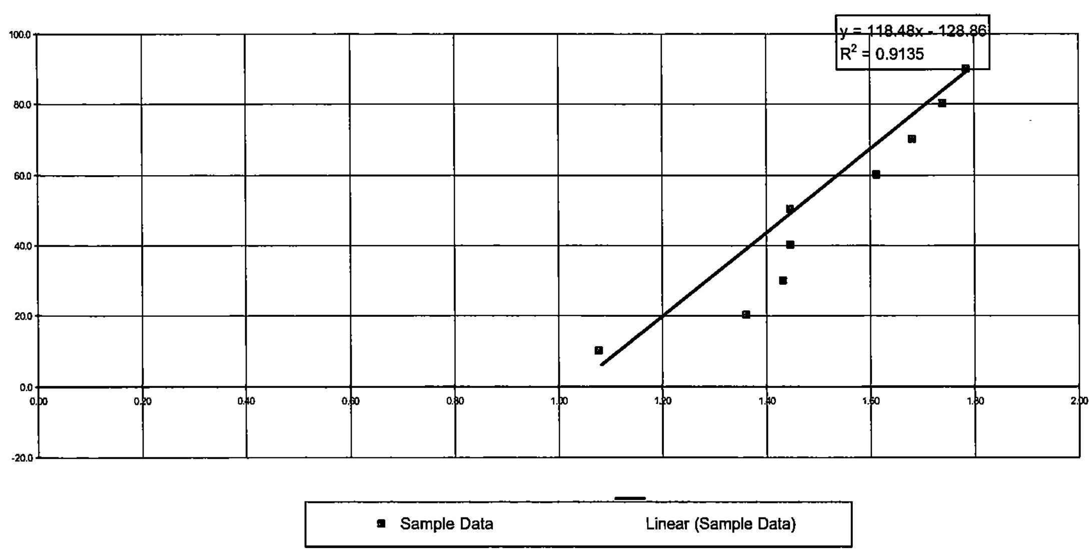
Normality?: Appears LogNormally Distributed

	log()
Number of Samples:	9
Sample Mean:	1.510
Sample Standard Devation:	0.221

25% Quatrile:	27.0
50% Quatrile(median):	28.0
75% Quatrile:	48.0
Inter-Quatrile Range:	21.00
Upper Cutoff:	79.50

	log()	Natural Scale
Required Level of Confidence:	95%	
Upper Confidence Limit:	1.65	
Upper Tolerance Limit:	1.94	87.6

PROBABILITY PLOT



STATISTICAL EVALUATION USING NORMAL DISTRIBUTION

PROJECT: Delphi Corporation - Vandalia Faciltiy - Vandalia, OH
LOCATION: MW-453D
COMPOUND: Trichloroethene
COMMENT:

Sample		Normal Distribution	
Order	Concentration	Probability	Quatrile
1	43	7.7	-1.43
2	43	15.4	-1.02
3	46	23.1	-0.74
4	47	30.8	-0.50
5	48	38.5	-0.29
6	51	46.2	-0.10
7	52	53.8	0.10
8	52	61.5	0.29
9	53	69.2	0.50
10	54	76.9	0.74
11	59	84.6	1.02
12	66	92.3	1.43
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Shapiro-Wilk Normality Test		
Residual	Coefficient (a)	Product (b)
23.00	0.5475	12.59
16.00	0.3325	5.32
8.00	0.2347	1.88
6.00	0.1586	0.95
4.00	0.0922	0.37
1.00	0.0303	0.03
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	

Shapiro-Wilk Sum:	21.141
Shapiro-Wilk W:	0.928
Critical Value:	5%
Shapiro-Wilk Comparison W:	0.8590

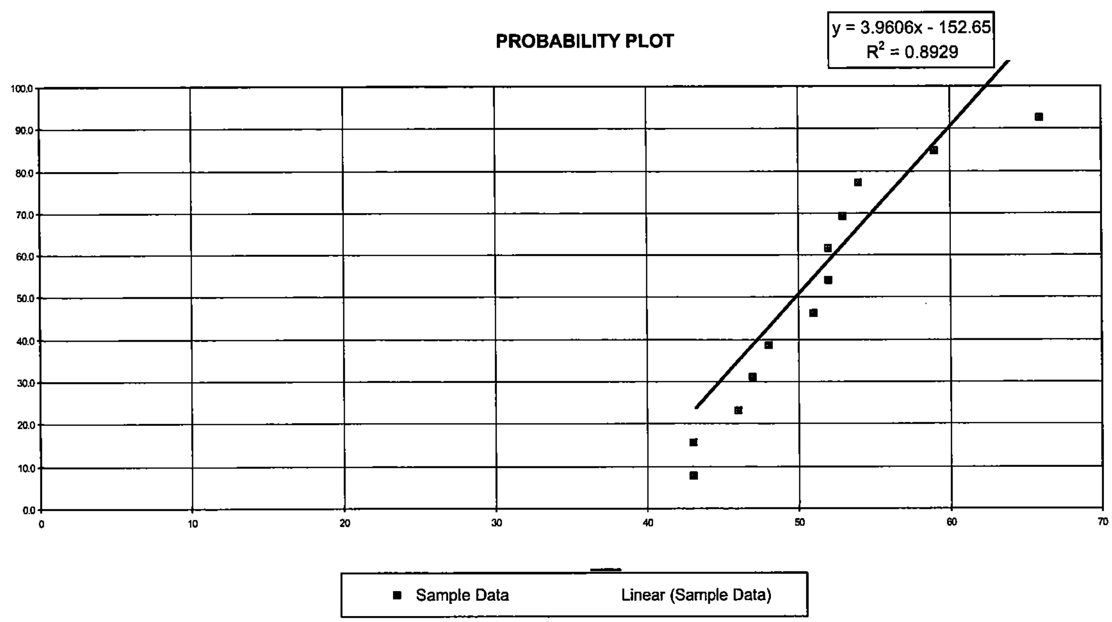
Normality?: Appears Normally Distributed

Number of Samples:	12
Sample Mean:	51.167
Sample Standard Devation:	6.617

25% Quatrile:	46.8
50% Quatrile(median):	51.5
75% Quatrile:	53.3
Inter-Quatrile Range:	6.5
Upper Cutoff:	63.0

Required Level of Confidence:	95%
Upper Confidence Limit:	54.60
Upper Tolerance Limit:	63.5

PROBABILITY PLOT



STATISTICAL EVALUATION USING LOG-NORMAL DISTRIBUTION

PROJECT: Delphi Corporation - Vandalia Faciltiy - Vandalia, OH
LOCATION: MW-453D
COMPOUND: Trichloroethene
COMMENT:

Sample Order	Sample Log Conc.
1	1.63
2	1.63
3	1.66
4	1.67
5	1.68
6	1.71
7	1.72
8	1.72
9	1.72
10	1.73
11	1.77
12	1.82
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Normal Distribution Probability	Normal Distribution Quatrile
7.7	-1.43
15.4	-1.02
23.1	-0.74
30.8	-0.50
38.5	-0.29
46.2	-0.10
53.8	0.10
61.5	0.29
69.2	0.50
76.9	0.74
84.6	1.02
92.3	1.43

Shapiro-Wilk Normality Test Residual	Coefficient (a)	Product (b)
0.19	0.5475	0.10
0.14	0.3325	0.05
0.07	0.2347	0.02
0.05	0.1586	0.01
0.03	0.0922	0.00
0.01	0.0303	0.00
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.0000	
	0.00	

Shapiro-Wilk Sum:	0.176
Shapiro-Wilk W:	0.950
Critical Value:	5.0%
Shapiro-Wilk Comparison W:	0.8590

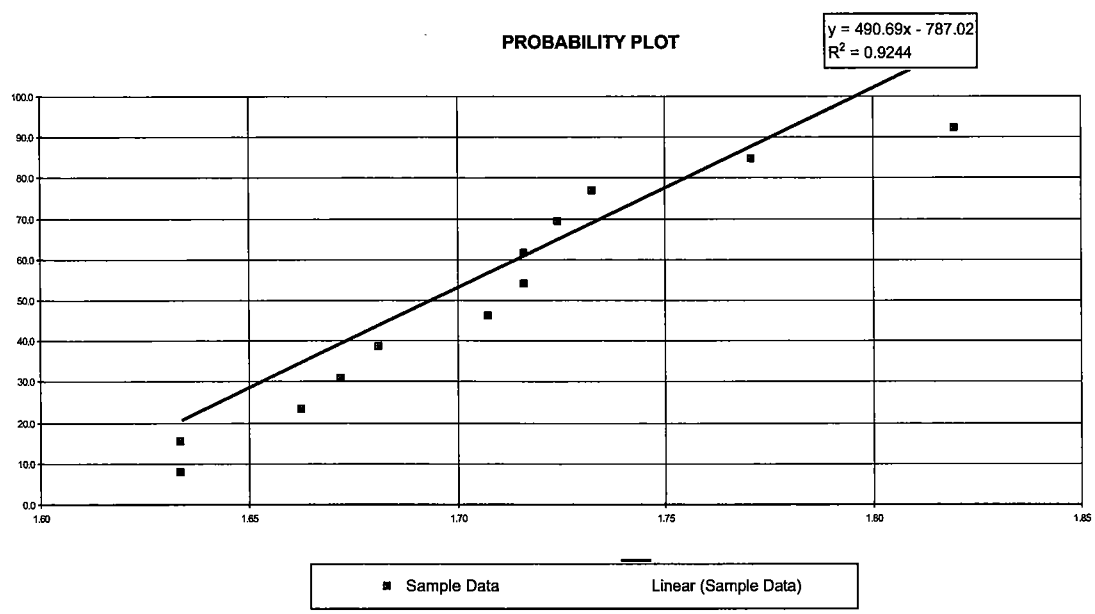
Normality?: Appears LogNormally Distributed

	log()
Number of Samples:	12
Sample Mean:	1.706
Sample Standard Devation:	0.054

25% Quatrile:	46.8
50% Quatrile(median):	51.5
75% Quatrile:	53.3
Inter-Quatrile Range:	6.50
Upper Cutoff:	63.00

	log()	Natural Scale
Required Level of Confidence:	95%	
Upper Confidence Limit:	1.73	
Upper Tolerance Limit:	1.81	64.2

PROBABILITY PLOT



APPENDIX C

Remediation System Evaluation (RSE) Report

REMEDIATION SYSTEM EVALUATION

DELPHI CORPORATION
VANDALIA, OHIO

Report of the Remediation System Evaluation,
Site Visit Conducted at the Delphi Corporation, Vandalia, Ohio Facility
March 6, 2003

Final Report
June 10, 2003

NOTICE

Work described herein was performed by GeoTrans, Inc. (GeoTrans) for the U.S. Environmental Protection Agency (U.S. EPA). Work conducted by GeoTrans, including preparation of this report, was performed under S&K Technologies Prime Contract No. GS06T02BND0723. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

EXECUTIVE SUMMARY

A Remediation System Evaluation (RSE) involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for up to 1.5 days, and compiling a report that includes recommendations to improve the system. Recommendations with cost and cost savings estimates are provided in the following four categories:

- improvements in remedy effectiveness
- reductions in operation and maintenance costs
- technical improvements
- gaining site closeout

The recommendations are intended to help the site team (the responsible party and the regulators) identify opportunities for improvements. In many cases, further analysis of a recommendation, beyond that provided in this report, may be needed prior to implementation of the recommendation. Note that the recommendations are based on an independent evaluation by the RSE team, and represent the opinions of the RSE team. These recommendations do not constitute requirements for future action, but rather are provided for the consideration of all site stakeholders.

This RSE pertains to aspects of the corrective action underway at two neighboring plants, the Delphi Energy and Chassis Systems Plant and Delphi Safety and Interior Systems Plant, collectively referred to as the "facility" in this report. The facility occupies approximately 136 acres on two tracts of land, with industrial activities occurring on the 82-acre southern tract. The 54-acre northern tract is partially developed for railways but is otherwise undeveloped. The facility is located adjacent to the Dayton International Airport in a mixed industrial, residential, commercial, and agricultural area.

Dense non-aqueous phase liquids (DNAPL) and volatile organic compound (VOC) contamination of soil and ground water have resulted in three primary interim measures:

- ground water migration control with a pump and treat system
- DNAPL recovery
- survey of ground water use in the area and connections to public water supplies

The RCRA Facility Investigation is currently underway. Completion is expected by the end of 2003, and final measures will be taken accordingly.

The RSE team observed an extremely well-managed remedy. Based on the RSE document review and site visit, the RSE team concludes that Delphi, their contractors, and EPA all have an excellent understanding of the complex site conditions, interim measures, ongoing investigation, and potential risks. Continuing efforts have been made by the site team as a whole to improve interim measures and conduct a comprehensive investigation. The observations and recommendations contained in this report are not intended to imply a deficiency in the work of either the system designers or operators but are offered as constructive suggestions in the best interest of the EPA, the public, and the facility.

Recommendations are provided with respect to effectiveness, cost reduction, and technical improvement. The recommendations to improve effectiveness include the following:

- More fully evaluate the potential for public contact with water at the seeps, and based on those results consider posting signs near impacted ground water seeps to inform the public that the water is not suitable for drinking
- Consider providing and maintaining a point-of-entry treatment system for a nearby residence with an impacted supply well
- Proceed with the planned corrective measures to address the seeping of impacted ground water in the overburden at the facility
- Proceed with lowering the pump in the extraction well to increase the extraction rate
- Avoid altering the site hydrogeology - do not seal old borings that may connect the Top of Rock and Sugar Rock aquifers

One recommendation is made to reduce cost, which is to modify the monitoring program and consider reducing the number of sampled wells and the sampling frequency. Estimated annual cost savings of $67,000 per year might result from implementing example reductions suggested by the RSE team. One recommendation is made for technical improvement, which is to consider replacing the corroding pipe in the treatment plant with PVC when replacement is necessary.

No specific recommendations are provided for gaining site closeout; however, the RSE team provides considerations for cost-effectively addressing this long-term remedy while maintaining protectiveness.

A table summarizing the recommendations, including estimated costs and/or savings associated with those recommendations, is presented in Section 7.0 of this report.

PREFACE

This report was prepared as part of a pilot project conducted by the United States Environmental Protection Agency (USEPA) Office of Solid Waste (OSW) and Technology Innovation Office (TIO). The objective of this project is to conduct Remediation System Evaluations (RSEs) of pump and treat systems under the Resource Conservation and Recovery Act. The following organizations are implementing this project.

Organization	Key Contact	Contact Information
USEPA Office of Solid Waste (OSW)	Guy Tomassoni	5303W USEPA Headquarters Ariel Rios Building 1200 Pennsylvania Avenue, N. W. Washington, DC 20460 phone: 703-308-8622 tomassoni.guy@epa.gov
USEPA Technology Innovation Office (USEPA TIO)	Kathy Yager	11 Technology Drive (ECA/OEME) North Chelmsford, MA 01863 phone: 617-918-8362 fax: 617-918-8427 yager.kathleen@epa.gov
GeoTrans, Inc. (Contractor to USEPA)	Doug Sutton	GeoTrans, Inc. 2 Paragon Way Freehold, NJ 07728 (732) 409-0344 Fax: (732) 409-3020 dsutton@geotransinc.com

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1.0 INTRODUCTION

1.1 PURPOSE

During fiscal years 2000, 2001, and 2002 Remediation System Evaluations (RSEs) were conducted at 24 Fund-lead pump and treat (P&T) sites (i.e., those sites with pump and treat systems funded and managed by Superfund and the States). Due to the opportunities for system optimization that arose from those RSEs, EPA TIO and OSW are performing a pilot study of conducting RSEs at RCRA sites. During fiscal year 2003, RSEs at up to 5 RCRA sites are planned in an effort to evaluate the effectiveness of this optimization tool for this class of sites. GeoTrans, Inc., an EPA contractor, is conducting these evaluations, and representatives from EPA OSW and TIO are attending the RSEs as observers.

The Remediation System Evaluation (RSE) process was developed by the US Army Corps of Engineers (USACE) and is documented on the following website:

http://www.environmental.usace.army.mil/library/guide/rsechk/rsechk.html

A RSE involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for 1 to 1.5 days, and compiling a report that includes recommendations to improve the system. Recommendations with cost and cost savings estimates are provided in the following four categories:

- improvements in remedy effectiveness
- reductions in operation and maintenance costs
- technical improvements
- gaining site closeout

The recommendations are intended to help the site team (the responsible party and the regulators) identify opportunities for improvements. In many cases, further analysis of a recommendation, beyond that provided in this report, might be needed prior to implementation of the recommendation. Note that the recommendations are based on an independent evaluation by the RSE team, and represent the opinions of the RSE team. These recommendations do not constitute requirements for future action, but rather are provided for the consideration of all site stakeholders.

The Delphi facility was selected by EPA OSW based on progress made toward Environmental Indicators and comments from the EPA project manager for the site. This report provides a brief background on the site and current operations, a summary of the observations made during a site visit, and recommendations for changes and additional studies. The cost impacts of the recommendations are also discussed.

1.2 TEAM COMPOSITION

The team conducting the RSE consisted of the following individuals:

Rob Greenwald, Hydrogeologist, GeoTrans, Inc.
Erik Petrovskis, Engineer, GeoTrans, Inc.
Peter Rich, Civil and Environmental Engineer, GeoTrans, Inc.
Doug Sutton, Water Resources Engineer, GeoTrans, Inc.

The RSE team was also accompanied by the following observers:

- Kathy Yager from EPA TIO
- Mike Fitzpatrick from EPA OSW

EPA-TIO and EPA-OSW are jointly conducting this RSE Pilot Study for RCRA sites.

1.3 DOCUMENTS REVIEWED

Author	Date	Title
Delphi	3/1999	Modification of NPDES Permit
Haley and Aldrich	5/1999	Description of Current Conditions
Ohio EPA	10/1999	Modification of NPDES Permit
US EPA	12/1999	Documentation of Environmental Indicator Determination
NOVA Consultants, Inc.	3/2000	Equipment Specifications, Vacuum Enhanced Groundwater/DNAPL Recovery and Treatment System
NOVA Consultants, Inc.	4/2000	Air Emission Calculation, Vacuum Enhanced Groundwater/DNAPL Recovery and Treatment System
US EPA	1/2002	Administrative Order on Consent
US EPA	2/2002	EPA Comments on the Description of Current Conditions Report
Haley and Aldrich	4/2002	Interim Measures and Implementation Report
Haley and Aldrich	4/2002	Progress Report, 1st Quarter 2002
US EPA	5/2002	EPA Comments on the Interim Measures and Implementation Report
Haley and Aldrich	7/2002	Progress Report, 2nd Quarter 2002
Haley and Aldrich	10/2002	Progress Report, 3rd Quarter 2002
Haley and Aldrich	1/2003	Progress Report, 4th Quarter 2002

1.4 PERSONS CONTACTED

The following individuals associated with the site were present for the visit:

Kenneth Bardo, Project Manager, EPA Region 5

Tom Byrne, Operator, Delphi Corporation
John Ridd, Project Manager, Delphi Corporation
Steve Weflen, Manager, Environmental Services, Delphi Corporation

Dave Bean, Operator, Haley & Aldrich
David Hagen, Vice President, Haley & Aldrich
Dennis Kreitzburg, Staff Environmental Geologist, Haley & Aldrich
James Little, Vice President, Haley & Aldrich

1.5 SITE LOCATION, HISTORY, AND CHARACTERISTICS

1.5.1 LOCATION

This RSE pertains to aspects of the corrective action underway at two neighboring plants, the Delphi Energy and Chassis Systems Plant and Delphi Safety and Interior Systems Plant, collectively referred to as the "facility" in this report. The Energy and Chassis Systems plant is located at 480 North Dixie Highway, and the Safety and Interior Systems Plant is located at 250 Northwoods Boulevard in Vandalia, Ohio. The facility occupies approximately 136 acres on two tracts of land, with industrial activities occurring on the 82-acre southern tract. The 54-acre northern tract is partially developed for railways but is otherwise undeveloped. The facility is located in a mixed industrial, residential, commercial, and agricultural area. The Dayton International airport is located to the west, on the other side of North Dixie Highway. The airport and light industrial facilities occupy land to northwest of the facility. Fields, wooded land, railways, and residential/commercial properties and railways are located to north and northeast. Interstate 75 is east of the facility. Fields, wooded, commercial, and agricultural lands are east of Interstate 75. Further east is Cassel Road with residences, and beyond Cassel Road is the Great Miami River. Land to the southeast and south of the facility is primarily residential. Figure 1-1 depicts the facility and the surrounding area.

Dense non-aqueous phase liquids (DNAPL) and volatile organic compound (VOC) contamination of soil and ground water have resulted in three primary interim measures:

- ground water migration control with a pump and treat system
- DNAPL recovery
- survey of ground water use in the area and connections to public water supplies

The RCRA Facility Investigation is currently underway. Completion is expected by the end of 2003, and final measures will be taken accordingly. A brief outline of the site history and future corrective action milestones are summarized below:

1941	-	Facility was first industrially developed by the Aeroproducts Division of General Motors.
1941-1958	-	Facility manufactured and tested airplane and helicopter blades and parts.

1958-1961	-	Facility was idle while manufacturing operations were restored.
1960s-1970s	-	Facility expanded operations.
1960s-present	-	Manufactured items include brake hoses, brake hose couplings, asbestos brake linings, foam set pads, coated vinyl sheeting, ball joints, steering wheels, steering wheel covers, air bags, instrument panels, and rubber bumpers.
1980s	-	Multiple spills, facility-wide closures of underground storage tanks (UST), and other activities occurred and are discussed. They are discussed in the Description of Current Conditions Report (May 1999).
1991-1993	-	Multiple monitoring wells and soil borings were installed to delineate contamination in soils and ground water found during UST closures in Tank Areas A through F and particularly in the area surrounding Tank Area C.
1992	-	Source of TCE identified at the NPDES outfall was investigated. In addition, a regional ground water investigation was undertaken by the Ohio EPA and CSX including the installation of bedrock monitoring wells. The installation of bedrock monitoring wells, including those installed offsite, has continued through 2002.
1995-1996	-	DNAPL was identified. An investigation was conducted to characterize and delineate the contamination, and a pilot program was initiated to test the feasibility of vacuum-enhanced DNAPL recovery.
1997-1998	-	Phase I and Phase II Environmental Site Assessments were conducted on the northern and southern tract in accordance with the Ohio Voluntary Action Program.
5/1999	-	Delphi submitted a Description of Current Conditions Report.
4/2000	-	Ground water migration control system began operation.
11/2000	-	DNAPL recovery system began operation. The system operated for 11 days in 2000 and 32 days in 2001.
2/2001	-	Delphi installed a new storm sewer to replace major sections of the existing system to prevent impacted ground water from infiltrating in to the storm sewers and discharging to surface water. The new sewer was constructed with impermeable HDPE and installed in a HDPE-lined trench that was backfilled with impermeable material. Other work included slip-lining another sewer with HDPE, replacing a manhole, and rerouting roof collectors. The abandoned sewers were blocked and sealed at both ends.
7-8/2001	-	A door-to-door survey water use survey was conducted. Approximately 800 locations were visited. Where active wells were identified, requests were made to sample the water. With permission, connections to public water are being provided and wells are being abandoned.
1/2002	-	An Administrative Consent Order was signed by Delphi and EPA.
4/2002	-	Delphi submitted an Interim Measures and Implementation Report.
6/2002	-	Delphi submitted a RCRA Facility Investigation (RFI) Work Plan.
10/2002	-	The DNAPL recovery system operation for 2002 was limited to October and 12 gallons of DNAPL was recovered. Operation is planned for the summer of 2003.

12/2003	-	The end of 2003 is the established deadline for the Environmental Indicator (EI) Report for Current Human Exposures Under Control and implementation of onsite work plan.
6/2004	-	This is the projected completion date for the offsite ground water investigation.
12/2004	-	The end of 2004 is the established deadline for the Environmental Indicator (EI) Report for Ground Water Stabilization.
8/2005	-	This is the projected completion date for the final investigation report.
12/2005	-	This is the established deadline for the Final Corrective Measure Proposal to be submitted.

1.5.2 POTENTIAL SOURCES

In February 1995, DNAPL was identified in Tank Area C. Although the release is no longer occurring (the tanks were excavated in the early 1990s), the DNAPL provides a potential ongoing source of dissolved ground water contamination. The extent of DNAPL in Tank Area C has been delineated and characterized. The plume is depicted in Figure 1-2. It is approximately 64% trichloroethylene and 22% 1,1,1-trichloroethane. The remaining constituents include carbon tetrachloride, methylene chloride, acetone, tetrachloroethane, and xylenes. The DNAPL appears to be limited to the upper layers of the overburden, but is a potential the source of dissolved contamination found in the underlying bedrock. An alternate possibility for the deeper dissolved contamination that persists in the bedrock is that historical DNAPL releases could have introduced DNAPL directly into the bedrock.

1.5.3 HYDROGEOLOGIC SETTING

The RFI Work Plan and other site documents state that the geologic strata in this area are typified by interbedded layers of glacial till and glacial outwash sand and gravel that lack horizontal continuity and overlie limestone and shale bedrock. Investigations at the facility have found that glacial deposits, consisting of till with silty and sandy lenses, extend to approximately 40-60 feet below ground surface. These glacial deposits overlie approximately 40 to 70 feet of dolomite from the Dayton Dolomite and Brassfield formations, which overlies approximately 75 feet of the Elkhorn Shale. The lowest few feet of the Brassfield is very porous and is commonly referred to as the "Sugar Rock".

At the facility, ground water is typically found within 3 to 8 feet of the ground surface, but on occasion has discharged to the surface through seeps. Such discharges are generally due to mounding of ground water caused by preferential flow through storm sewers. Horizontal ground water flow in the overburden is typically to the northeast and primarily flows through the sand and silt lenses. The hydraulic conductivity within the overburden ranges from 6.9×10^{-7} to 3.5×10^{-3} cm/sec. Three hydrostratigraphic units have been identified in the overburden: the Shallow, First, and Second Sands. The First Sand, where the DNAPL has been found, is approximately 10 to 15 feet below ground surface (bgs) and is approximately 1 to 3 feet thick where present. DNAPL has not been identified in the Second Sand unit, which is approximately 20 to 30 feet bgs.

The Top of Rock zone is fractured and weathered, and the ground water in this unit is confined by the overburden and the underlying bedrock. The hydraulic conductivity of this unit ranges from 6.2×10^{-5} to 1.6×10^{-3} cm/sec.

The Sugar Rock, which is separated from the Top of Rock by the less conductive dolomite of the upper Brassfield, forms a third hydrostratigraphic unit with a hydraulic conductivity ranging from 10^{-4} to 10^{-2} cm/sec. The piezometric surface in this unit is generally 25 to 40 feet lower than the water level in the Top of Rock unit, providing a substantial driving force for downward flow from the Top of Rock to the Sugar Rock through either natural or artificial passage ways. Previous efforts had been made to drill production wells for manufacturing purposes and resulting borings may provide a conduit for such flow. Horizontal flow in the Sugar Rock is to the east toward the Great Miami River. The Sugar Rock is exposed at the surface along the river valley where ground water discharges in multiple seeps. Intermittent pumping at an average rate of 80 gpm from another industrial facility to the southeast of the Delphi facility influences ground water flow and appears to cause a component of flow to the south/southeast. That facility has historically been called Leland Electric Systems, but the name was recently changed to Smith Aerospace.

1.5.4 POTENTIAL RECEPTORS

Potential receptors include private supply wells at residences, an Unnamed Tributary to North Creek, surface water at seep locations, the Great Miami River, and potential areas for vapor intrusion.

- The private supply wells within one mile of the site are being addressed in an interim measure water use survey. Wells with detectable concentrations of TCE are located on Engle Road to the north (one well that has always been below the MCL) and Cassel Road to the east. The well on Engle Road has an open intake that extends from the Top of Rock to the Sugar Rock, and the wells along Cassel Road are screened in the Sugar Rock.

- TCE impacted ground water has discharged to the Unnamed Tributary to the north of the facility by seeping into storm sewers that discharge to this unnamed tributary or by mounding of ground water that resulted in surface seeps that drain into the creek. Replacement of the storm sewer and other work reduced the discharge, but additional efforts have been required, including the use of a sump pump to assist with dewatering of the abandoned storm sewers. Additional efforts will likely include removing drain tiles that allow infiltration, converting an unused storm sewer into a collection trench, and extracting and treating the collected water.

- Ground water from the Sugar Rock aquifer discharges to seeps along Great Miami River valley. The discharged water travels a few hundred feet before reaching the river. TCE concentrations of over 300 ug/L have been detected in some of the seeps.

- The east tunnel inside the Delphi facility has been identified as a potential area for vapor intrusion due to its proximity to Tank Area C. Other areas with potential for vapor intrusion may be identified during the remainder of the RFI.

1.5.5 DESCRIPTION OF GROUND WATER PLUME

Dissolved ground water contamination consists primarily of TCE and cis-1,2-dichloroethylene (cis-1,2-DCE). Contamination in the overburden is heavily influenced by the presence of DNAPL in the First Sand unit. Although TCE concentrations greater than 500 ug/L are present in the overburden in other areas of the facility, the majority of the dissolved TCE contamination is in the vicinity of the DNAPL plume. Additional investigation within this unit is ongoing and was not available for review at the time of the RSE.

Dissolved ground water contamination in the Top of Rock zone (see Figure 1-3) appears to be controlled by a piezometric low near MW-424S (see Section 4.2.1 and 4.2.2 of this report) where water in the Top of Rock appears to discharge to the underlying Sugar Rock. Wells upgradient of this area historically have elevated TCE concentrations. For example, in the fourth quarter of 2002, MW-422S had a TCE concentration of 200,000 ug/L. Wells downgradient of this area (MW-423S, MW-445S, MW-446S, and others) have undetectable TCE concentrations. Although this piezometric low appears to capture site-related contamination within the Top of Rock aquifer, one supply well at a property located on Engle Road, located just north of the facility, has detectable concentrations of TCE that are below the MCLs. However, that well on Engle Road has an open intake that extends from the Top of Rock to the Sugar Rock, so the contamination at that well is likely drawn from the Sugar Rock.

Ground water contamination in the Sugar Rock extends over a mile from the site to the east. The highest concentration in this unit is repeatedly detected at MW-424D (see Figure 1-4 for location), which is located in the area where TCE impacted water from the Top of Rock zone is suspected to enter the Sugar Rock through an old production well boring. During the fourth quarter of 2002, MW-424D had a TCE concentration of 30,000 ug/L. Elevated concentrations of cis-1,2-DCE and 1,1 DCA were also detected (5,000 ug/L cis-1,2-DCE and 290 ug/L 1,1 DCA). Concentrations offsite to the east decrease near P-301, which is the extraction well for the ground water migration control system, and then increase again approximately 3,000 feet from the facility. In the first quarter of 2003, the TCE concentrations along Cassel Road were over 1,000 ug/L (1,200 ug/L in MW-411D and 1,400 ug/L in MW-412D). Beyond these points ground water discharge through seeps to surface water that eventually empties into the Great Miami River.

TCE contamination in the Sugar Rock is also present to the southeast of the facility but at significantly lower concentrations than those found elsewhere in the vicinity. For example, south of MW-433D, the TCE concentrations were below 50 ug/L during the first quarter of 2003, with the exception of MW-453D, which had a concentration of 52 ug/L. This area would likely be side-gradient to the facility under regional ground water flow, but pumping from the Leland/Smith facility may establish a component of ground water flow in this direction.

2.0 SYSTEM DESCRIPTION

Two active remediation systems are currently in place at the facility: the DNAPL recovery system and the ground water migration control system. These systems are described separately.

2.1 DNAPL RECOVERY SYSTEM

Thirteen 6-inch diameter stainless steel recovery wells are installed into the First Sand unit for DNAPL recovery (see Figure 1-2 for locations). A mobile extraction and treatment system operates seasonally from April to October and is typically employed at a well for 3 to 5 days then moved to one of the other 13 recovery wells. The DNAPL recovery system includes a QED Hammerhead pneumatic submersible pump, a Busch vacuum pump to vacuum enhance recovery, a phase separator, bag filter and 2 polymeric resin vessels in series. After treatment coproduced water is stored prior to discharge to the POTW. The system operates 40 hours per week with full time operator attention to visually inspect the system influent and make adjustments to the vacuum level and pumping rate.

2.2 GROUND WATER MIGRATION CONTROL SYSTEM

This system consists of a single recovery well (P-301) screened in the Sugar Rock with a variable speed drive 1.5 HP electric submersible pump. Due to discharge permit requirements, the pumping rate is limited to a 50 gpm maximum, but the pump runs continuously at approximately 45 gpm to maintain a set level in the well. Water is routed from the well head to the treatment building through 2-inch diameter HDPE pipe (which replaced originally installed carbon steel pipe) contained in 4-inch diameter PVC.

The treatment building is a 24-foot by 24-foot Parkline pre-engineered building with a curbed concrete floor and containment sump. Water enters the plant, and the sequestering agent Drewsperse is injected prior to the 2,000 gallon HDPE feed tank. From the feed tank, water is pumped by a 1.5 HP pump on a batch basis to a CarbonAir 4 tray model Stat 180 air stripper (200 gpm capacity). The air stripper has a 7.5HP blower, and during the winter a 15 kW heater warms the air that enters the building due to the suction of the blower. The air stripper effluent is pumped by a 1.5 HP pump through a 4-inch diameter HDPE discharge line to the NPDES discharge point at a catch basin east of the facility that connects to the East Channel. A Rosedale Products duplex bag filter and two liquid GAC units, each with a capacity of 900 pounds, were previously used for effluent polishing but are currently bypassed because the air stripper effectively treats the water to discharge standards.

The current system influent has 2.2 to 4.3 mg/l total VOCs with about 70% TCE (3rd Quarter 2002). This concentration and flow rate results in a total VOC mass removal of up to 2.3 lbs/day as shown below, which is well below the reported 10 lb/day de minimus limit for direct discharge from the air stripper and tank vent to the atmosphere. The system has appropriate failsafes and alarm communication functions and is checked on a weekly basis.

$$\frac{45\text{ gal.}}{\text{min.}} \times \frac{3.785\text{ L}}{\text{gal.}} \times \frac{4{,}300\text{ ug}}{\text{L}} \times \frac{1440\text{ min.}}{\text{day}} \times \frac{2.2\text{ lbs.}}{1 \times 10^9\text{ ug}} = \frac{2.32\text{ lbs.}}{\text{day}}$$

2.3 MONITORING PROGRAM

The ground water monitoring program utilizes a total of 67 bedrock monitoring wells. Regular monitoring is not conducted in the overburden, though storm sewers have been sampled to determine the cause of seeps and impacts to the Unnamed Tributary. Additional investigation in the overburden is underway as part of the RFI, but this information was not available at the time of the RSE.

Of the 67 wells, 23 are screened in the Top of Rock, 41 are screened in the Sugar Rock, and 3 other wells are screened intermediate to these two units. Ground water elevations are measured in each Sugar Rock well on a monthly basis and in each Top of Rock well on a quarterly basis. Potentiometric surfaces for each unit are developed for each round of measurements to assist in interpreting plume control. Water quality sampling and analysis for VOCs is conducted at approximately 47 wells (assuming access is available) on a quarterly basis and the remaining 20 wells on an annual basis. Sampling and analysis for VOCs is conducted at 7 surface water locations on a quarterly basis. Samples are collected and analyzed and flow rates are measured at 11 seeps annually. This sampling totals approximately 247 samples per year, and each sample is analyzed using EPA Method 8260b.

For process monitoring, the influent concentration from the recovery well and the effluent concentration are sampled monthly and analyzed for VOCs with EPA Method 624. For the DNAPL recovery system, chemical analysis is performed on treated effluent that is stored in holding tanks before that effluent is discharged to the POTW.

Collected data are presented in quarterly progress reports. The reports include work performed during the quarter, data collected, problems encountered, and an update on the project schedule. Although tables and figures are made to present the data, interpretations of the data are not provided in the progress reports.

3.0 SYSTEM OBJECTIVES, PERFORMANCE AND CLOSURE CRITERIA

3.1 CURRENT SYSTEM OBJECTIVES AND CLOSURE CRITERIA

Currently, the site is in the investigation phase; however, due to ground water contamination and the presence of DNAPL, interim measures have been implemented. The goals for the interim measures, as described in the Interim Measures and Implementation Report, are as follows:

> **Ground water migration control system** - control the migration of site contaminants at the eastern (downgradient) property boundary in the Sugar Rock aquifer. Control of plume migration in the Top of Rock is not a goal of this system.
>
> **DNAPL recovery system** - remove, to the extent practical, free DNAPL from the area identified as containing this material, using a vacuum enhanced system designed specifically for such purpose. It is not the intent of the system to remediate contaminated media in the form ground water, soil, or soil vapor. Operation of the system will be discontinued when measurable free product can no longer be recovered from each of the existing recovery wells.
>
> **Water Use Survey** - sample private wells within the study area and replace water systems along Cassel Road.

The overall remedial objective for the facility is to achieve an EPA-approved determination of Completion of Corrective Action Activities and terminate interim status as a RCRA storage facility. The path to completion involves the typical phases of investigation and remediation under the RCRA Corrective Action Program, which include, investigating the site, assessing risk, developing media protection standards and objectives, performing a Corrective Measures Study, implementing the selected Corrective Measure, and final site closure/completion. In addition to the overall objective, the facility also has the short-term objective of achieving site stabilization through the demonstration of achievement of Environmental Indicators CA725 – Current Human Exposures Under Control and CA750 – Migration of Contaminated Groundwater Under Control. A report detailing the achievement of CA725 is due by the end of 2003, and a report detailing the achievement of CA750 is due by the end of 2004.

A proposal for a final Corrective Measure is due by the end of 2005 and will depend on the results of the ongoing RFI. This RSE report focuses primarily on the interim measures, but some of the recommendations in Section 6.0 of this report may pertain to the final remedy, if the final remedy resembles the currently implemented interim measures.

3.2 TREATMENT PLANT OPERATION STANDARDS

The groundwater migration control system discharges to surface water in accordance with a NPDES permit. The permitted discharge requirements are summarized in the following table. The maximum permitted flow is 50 gpm, and the permitted mass loading rates are calculated based on this maximum permitted flow.